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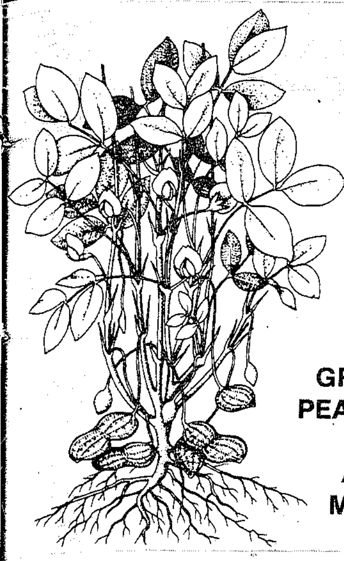
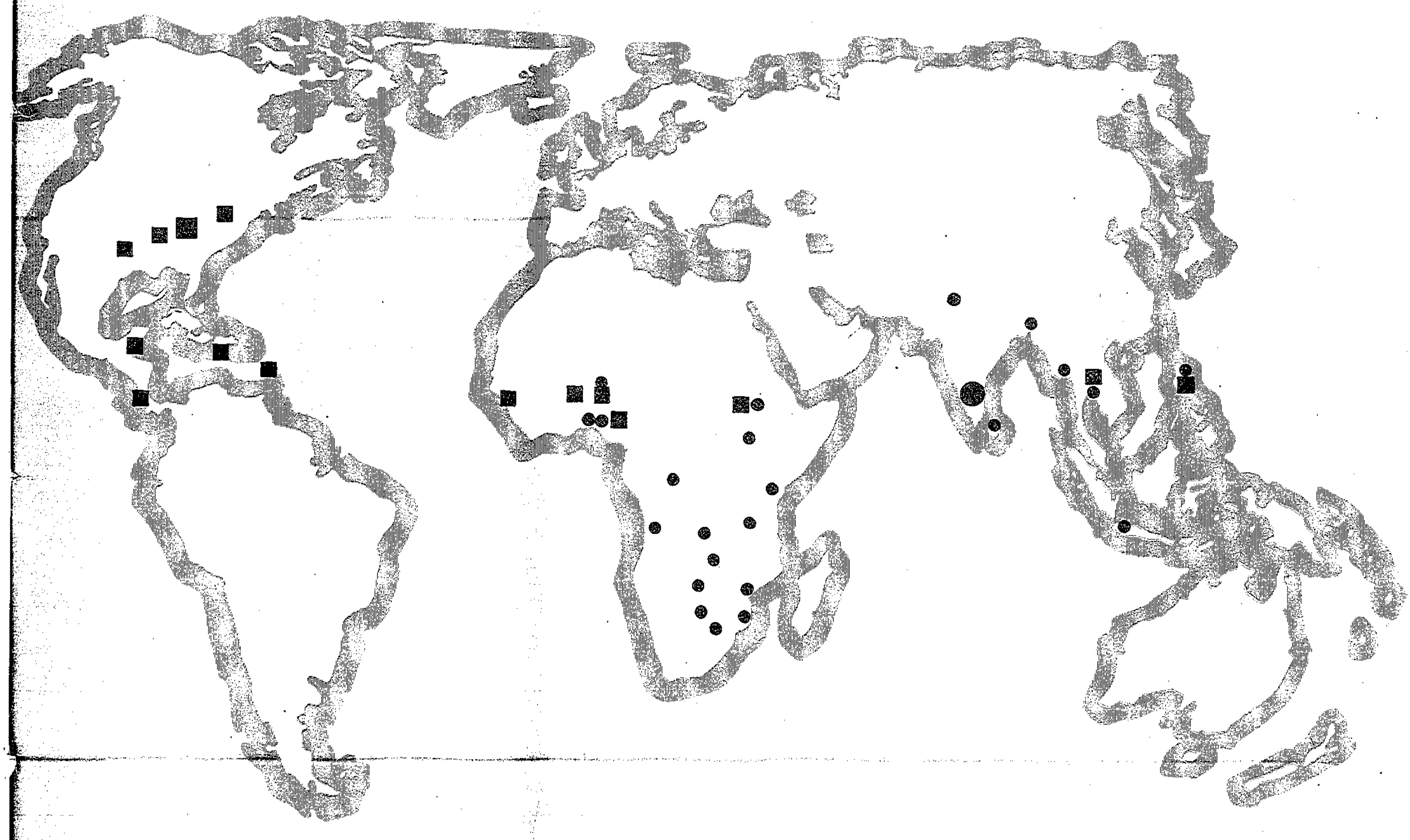


GROUNDNUT,
PEANUT, MANÍ,
ARACHIDE,
AMENDOIM,
MUNGPHALI.

International Arachis Newsletter

Prepared by
LEGUMES PROGRAM, ICRISAT
Patancheru, Andhra Pradesh 502 324, India

o. 3 May 1988



- ● ICRISAT Center, Patancheru
- • Other ICRISAT Locations
- ■ Peanut CRSP, Georgia
- ▪ Other CRSP Locations

International Arachis Newsletter

Publishing Objectives

The International Arachis Newsletter is issued twice a year (in May and November) by the Legumes Program, ICRISAT in cooperation with Peanut Collaborative Research Support Program, USA. It is intended as a communication link for workers throughout the world who are interested in the research and development of groundnut *Arachis hypogaea*, or peanut, and its wild relatives. The Newsletter is therefore a vehicle for the publication of brief statements of advances in scientific research that have current-awareness value to peer scientists, particularly those working in developing countries. Contributions to the Newsletter are selected for their news interest as well as their scientific content, in the expectation that the work reported may be further developed and formally published later in refereed journals. It is thus assumed that Newsletter contributions will not be cited unless no alternative reference is available.

Style and Form for Contributions

We will carefully consider all submitted contributions and will include in the Newsletter those that are of acceptable scientific standard and conform to the requirements given below.

The language for the Newsletter is English, but we will do our best to translate articles submitted in other languages. Authors should closely follow the style of reports in this issue. Contributions that deviate markedly from this style will be returned for revision. Submission of a contribution that does not meet these requirements can result in missing the publication date. Contributions received by 1 February or 1 August will normally be included in the next issue.

If necessary, we will edit communications so as to preserve a uniform style throughout the Newsletter. This editing may lead to the shortening of some contributions, but particular care will be taken to ensure that the editing will not change the meaning and scientific content of the article. Wherever we consider that substantial editing is required, we will send a draft copy of the edited version to the contributor for approval before printing.

A communication should not exceed 600 words, and may include a maximum of two relevant and well-prepared tables, *or* figures, *or* diagrams, *or* photographs. Tables must not exceed 85 characters in width. Each communication should normally be confined to a single subject and should be of primary interest to Arachis workers. The references cited should be directly relevant and necessary to supplement the article's content. All contributions should be typed in double spacing and two copies submitted.

SI units should be used. Yield should be reported in kg ha^{-1}. A "Guide to Authors" is available from the Editor.

Address all communications, and requests for inclusion in the mailing list, to:

The Editor
International Arachis Newsletter
Legumes Program
ICRISAT, Patancheru
Andhra Pradesh 502 324
INDIA

Cover Illustration: *Arachis hypogaea* and some alternative names for groundnut.

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Editorial

A newsletter has been an interest of both ICRISAT and the Peanut Collaborative Research Support Program (CRSP), USA, for many years, and it was natural that ICRISAT should ask Peanut CRSP if they wished to cooperate in the production of the International Arachis Newsletter (IAN). Their enthusiastic response has resulted in contributions to all editions of IAN, and the Board of Peanut CRSP has approved a substantial contribution towards production costs. Thank you Peanut CRSP, for all the support you have given us.

February and August bring a flurry of activity in the editorial office. This involves checking the status of research reports, and calling for news from various sources. The editorial staff has been greatly strengthened by the addition of L.J. Reddy as a second editor. He has many years' experience as a breeder. Also contributing to the production of the newsletter is J.J. Abraham of ICRISAT Information Services, who is the technical editor for all three legumes newsletters.

The second newsletter contained a report on groundnut cultivation in Cyprus, and this edition contains a report on the work of the Indian National Research Centre for Groundnut, Junagadh, Gujarat. Please send us similar articles on aspects of groundnut production or research in your country that you consider to be of general interest.

The newsletter is mailed to a number of individuals and libraries who receive ICRISAT publications, and to all those on the IAN circulation list maintained by ICRISAT Legumes Program. This circulation list forms a valuable database that has been used to answer a number of queries, such as "how many scientists are interested in groundnut pathology, and who are they" or "what are the names and addresses of all groundnut scientists in Georgia", the latter a request from a scientist going on tour. We are now preparing a more comprehensive database of groundnut scientists. If your mailing label has a number in the top line, we ask you to fill in and return the questionnaire enclosed with this newsletter. As the new database will be used to generate the mailing labels, **only those who return the questionnaire will receive future issues.** If the number on your mailing label is in [ ] at the lower right corner, you will continue to receive IAN without having to return a questionnaire.

J.P. Moss
L.J. Reddy

Letter to the Editor

Dear Editor:

I read with great enthusiasm your article on the suggested method of applying inoculum onto groundnut seed (International Arachis Newsletter, May 1987).

I particularly want to know what ratio of water to inoculum is recommended in making the slurry and how your recommended method can be applied in large-scale farming. Details of the method will be gratefully appreciated.

Has granulated inoculum been considered as another alternative? If so, how can it be produced and what would the application rate be on a per hectare basis?

Sincerely yours,
R.C. Nyemba
Soil Microbiologist
Ministry of Agriculture and Water Development
Chilanga
Zambia

ICRISAT Microbiologists reply:

1. Peat inoculum is mixed in water so as to give a Rhizobium *count of 10^6 cells mL^{-1} of peat suspension. One gram of peat inoculum containing 10^9 cells of* Rhizobium *is mixed with 1 L of water, and added to the seed furrows at the rate of 5 mL $seed^{-1}$, using a plastic jerry can fitted with a long flexible tube. With experience, by holding the jerry can in one hand and the tube in the other, the right amount of liquid inoculum can be applied all along the seed furrows. The seeds are then placed over the inoculum, covered, and irrigated immediately.*

2. A bullock-drawn country plow can be easily modified by attaching a container of suitable volume to hold the liquid inoculum. Usually the container can be hung at the front of the plow with a long tube running to the base of the plow. Large areas can be inoculated in this way.

3. Granulated inoculum can be an alternate method to slurry/liquid inoculum, but we observed that slurry/liquid form is preferable over granular form.

4. The method of preparing the granular inoculum is as follows: Mix 70 g of peat inoculum (containing 10^9 to 10^{10} cells g^{-1}) in 800 mL of aqueous methyl cellulose (1.5% w/v) and then coat this solution evenly onto 5.5 kg of washed river sand, and air dry in shade for 8-12 h. One to two grams of this granular inoculum is placed below the seed (to provide a minimum of 10^6 Rhizobium cells seed^{-1}) at the time of sowing.

News from ICRISAT Center

Dr Kanwar Retires from ICRISAT

ICRISAT Deputy Director General J.S. Kanwar retired 31 Mar 1988, after 15 years of distinguished service at ICRISAT.

Dr Kanwar was one of the persons involved in setting up ICRISAT Center. He joined ICRISAT later, in 1973, as Associate Director of Research, a position subsequently redesignated as Director of Research and then as Deputy Director General.

Dr Kanwar obtained his BSc in Agriculture, and undertook teaching and research. After obtaining an MSc in Agricultural Chemistry, he went to the University of Adelaide, Australia, to study for his PhD. On his return to Punjab, he undertook important research on many aspects of soil science. His work on micronutrients is particularly well-known.

Dr Kanwar had a long and distinguished career and held many important positions, including Director of Research at Punjab Agricultural University, and Deputy Director General (Soils) of the Indian Council of Agricultural Research. While at ICRISAT, he contributed extensively both to the physical development of the facilities at ICRISAT Center and the establishment of the research programs and support services. The quality of these is a lasting testimonial to his outstanding abilities. He has played an important part in establishing ICRISAT's international links and the development of ICRISAT's Sahelian Center, Regional Programs, and Subcenters.

We wish Dr Kanwar a long, happy, and active retirement.

New Abstract Service Commences

The Semi-Arid Tropical Crops Information Service (SATCRIS), at ICRISAT, commenced its automated Selected Dissemination of Information (SDI) Service. The new service is based on data received from two major agricultural science databases, i.e., the Commonwealth Agricultural Bureaux (CAB) and the Information System for Agricultural Sciences and Technology (AGRIS), and covers information on all the five crops mandated to ICRISAT.

The SDI service attempts to alert users to current information in their specific areas of interest. The service can be tailored to suit the ongoing information needs of an individual researcher or a small group.

The service, which began in March 1988, now goes to 138 users in 27 countries of the Semi-Arid Tropics (SAT).

SATCRIS welcomes new users to the SDI service. For a SDI Service Request Form write to SATCRIS, ICRISAT, Patancheru, Andhra Pradesh 502 324, India.

Asian Grain Legumes Network

The Asian Grain Legumes Network (AGLN) was established in January 1986 to assist the national programs in South and Southeast Asia in transferring technology (including plant material and related agronomy) to increase production of groundnut, chickpea, and pigeonpea (IAN 1:16-17, 2:2-3). The "AGLN Cooperators Report, no.1", released in December 1987, records the activities of AGLN, and also includes summaries of the work plans for AGLN countries.

The 'Work-Plan Meetings' have helped AGLN to develop annual work plans for Bangladesh, Burma, Nepal, Pakistan, and Sri Lanka. AGLN has tentative work plans for other countries in the region.

Based on the work plans developed for each country, the following activities were carried out:

1. Following the Peanut Stripe Virus (PStV) Coordinators' Meeting, held 9-12 Jun 1987 at Malang, Indonesia, AGLN-ICRISAT has been asked to coordinate future research on PStV. Participating Asian countries, USA, and Australia have nominated coordinators, who are expected to coordinate research on PStV in their countries.

2. Another major activity concerning PStV was the field screening of 6500 germplasm lines for resistance to PStV. The screening was done at two locations in Indonesia (Baru in Sulawesi and Muneng in Java) and funded by a joint project involving the Australian Centre for International Agricultural Research, the Australian Development Assistance Bureau, and ICRISAT. Disease-free lines will be retested in the laboratory and/or greenhouses.

3. A groundnut breeder, a pathologist, and a nematologist monitored groundnut trials and surveyed the farmers' crop in Nepal. Bud necrosis disease (tomato spotted wilt virus) and late leaf spot were very common. Nematodes were not affecting groundnuts. Among the insects seen, jassids and termites were important.

4. A groundnut germplasm botanist visited Burma to impart training on germplasm collection, maintenance, and evaluation. Forty local groundnut landraces were collected for the ICRISAT gene bank.

The country-AGLN work plan meetings are planned to be held during May-July 1988 to review results and plan for the next season. Other planned meetings are:

1. Workshop on Agroclimatology of AGLN countries, 5-16 Dec 1988.
2. Workshop on Regional Legumes Networks, 17-21 Dec 1988.
3. Groundnut Scientists' Meeting, Thailand.
4. Training course on identification of groundnut viruses with special reference to peanut stripe virus, 11-25 Jul 1988, Malang, Indonesia.

LEGOFTEN Activities

The trials on groundnut yield maximization in rainy season of 1987 have been completed and those in postrainy season 1987/88 are being assessed. Constant monitoring of these trials has brought out many constraints that need to be overcome. The three major components that interact with each other to produce the final results are the technology changes, the farmers (producers), and the suppliers of inputs. Incentives to farmers to cultivate groundnut also play a part. The major production constraints are nonavailability of good quality seed, improper seed beds, nutritional imbalances, erratic rainfall, and pests and diseases. Most farmers lack the skills necessary to cultivate groundnut. Therefore, proper training of farmers will be very useful. However, contrary to common belief, farmers did respond favorably to technology change. The profitability of the crop is the strongest motivation for them to grow groundnuts, but a substantial increase in yield has to be demonstrated before the farmers consider changing established production practices. As regards to suppliers of various inputs, though fertilizers and pesticides are freely available, the major handicap is in the supply of labor-saving, efficient implements such as seed drills, plant diggers, and pesticide applicators.

The trials on pigeonpea and chickpea will be undertaken from June 1988. The short-duration, high-yielding varieties of pigeonpea, ICPL 87 and ICPL 151, and of chickpea, ICCV 2, ICCC 32, and ICCC 37 have been identified. Major emphasis would be to use wilt-resistant or wilt-escaping varieties and good *Heliothis* control. Use of efficient and cheap, modified ultra-low volume sprayer and proper selection of pesticides (to avoid the build-up of resistance) will be demonstrated.

Seed multiplication of improved varieties is one of the major activities. LEGOFTEN plans to distribute small quantity of seed to a large number of farmers to serve as nuclei of seed multiplication. About 3 t seed of each of the promising varieties of groundnut, pigeonpea, and chickpea has been produced for distribution.

News About ICRISAT Center Groundnut Scientists

D.C. Sastry, Cytogeneticist, proceeded on sabbatical leave in January 1988, for 1 year. He is working with R. Appels and W.J. Peacock in the CSIRO laboratories in Canberra, Australia. He will be studying a range of techniques, including means of detection of introduced DNA, which will be relevant to ICRISAT's work on wide hybridization.

J.H. Williams, Principal Physiologist, is on sabbatical leave to work as a visiting scientist with Prof. G.S. Campbell, Department of Agronomy and Soils, Washington State University, Pullman, WA 99164-6420, USA, from June 1987 to May 1988.

P.T.C. Nambiar, Microbiologist, has been on sabbatical leave and was working with Prof. V.N. Iyer, Department of Biology, Carleton University, Ottawa K1S 5B6, Canada, from April 1987 to March 1988.

News from the ICRISAT Sahelian Center

West African Regional Groundnut Workshop

The First Regional Workshop on Groundnut Production and Improvement in West Africa will be held in Niamey, Niger, 13-16 Sep 1988. The objectives of the workshop are to:

a. Provide an opportunity for participating scientists to share experiences on the status of groundnut production and improvement in various countries in the region.
b. Define areas along which collaborative research can be developed and/or strengthened in the region.

The workshop is planned for 4 days, including field visits.

Invitations have been extended to National Agricultural Research Services in groundnut-growing areas in the West African Region, Institut de recherches pour les huiles et oléagineux (IRHO), Peanut CRSP, Institut francais de recherche scientifique pour le development en cooperation (ORSTOM), Food and Agricultural Organization of the United Nations (FAO), Centre regional de formation et d'application en agrometeorologie et hydrologie operationnelle (AGRHYMET), and the African Groundnut Council, ICRISAT Center, and the Southern African Development Coordination Conference (SADCC)/ICRISAT Regional Groundnut Improvement Program.

ISC Groundnut Improvement Program Staff Travel

P. Subrahmanyam, Principal Pathologist, visited the Republic of Guinea, 23-28 Oct 1988, to obtain information about groundnut production in the country, and to establish contacts with scientists working on groundnut, and to identify areas of possible collaborative research. He also discussed the performance of ICRISAT material in Guinea.

P. Subrahmanyam participated in the Aflatoxin Workshop held at ICRISAT Center in October 1987. This meeting was also attended by **R.W. Gibbons,** Executive Director, West African Programs and Director, ISC.

B.J. Ndunguru, Principal Agronomist, visited Mali and Senegal, 30 Sep-10 Oct 1987, to meet groundnut researchers, to familiarize with the research activities, and to explore possible areas of collaboration.

D.C. Greenberg, Principal Breeder, visited India and Malawi 29 Oct-18 Nov 1987, to discuss the relationship between the breeding programs in India, the SADCC-member countries, and West Africa and to set up a joint breeding program for rosette resistance between the West Africa and the SADCC programs.

News from Peanut CRSP

Dr D. Cummins returned to the Management Entity of Peanut CRSP at the end of April. Dr Cummins has been on a Joint Career Corporation tour of duty with the USAID office in Manila for the past 2 years. **Dr T. Nakayama** will return to the Department of Food Science at the Georgia Experiment Station.

Three scientists from the Peanut CRSP participated in the Peanut Utilization Symposium in Singapore: **Dr V. Garcia** from the University of the Philippines at Los Banos; **Dr V. Haruthaithansan** from Kasetsart University, Bangkok, Thailand; and **Dr R. Brackett** from the University of Georgia, Georgia Experiment Station.

Drs J. Demski, Griffin, and **C. Kuhn,** Athens, both from University of Georgia, met in London with collaborators from Nigeria, **(Drs S. Misari** and **O. Ansa,**) and from FRG **[Dr R. Casper** (Virus Institute in Braunschweig)] for a planning meeting of the Peanut CRSP groundnut rosette virus disease project.

Dr W.V. Campbell, North Carolina State University, made a trip to Khon Kaen, Thailand, in connection with the entomology project and **Dr M. Beute** traveled to Bangkok and Khon Kaen in connection with the breeding project.

Dr L. Beuchat visited Kasetsart University in Bangkok, and the University of the Philippines at Los Baños on his return from a consultation visit in Malaysia.

Dr M. Chinnan of the postharvest handling project from the University of Georgia, Griffin, visited Belize to evaluate the progress of the project and plan the future program.

Oilcrops Newsletter

Readers may be interested in the Oilcrops Newsletter, published by the Oil Crops Network Project for East Africa and South Asia, with support from the International Development Research Centre (IDRC), Canada. The newsletter contains a wide range of reports, papers, and a bibliography covering oilcrops, including groundnut, though the editor is forwarding some articles on groundnut to IAN when appropriate.

Further information is available from the editor Dr A. O. Omran, Oilcrops Network for East Africa and South Asia (IDRC), Holetta Research Centre, P.O. Box 23464 or 2003, Addis Ababa, Ethiopia.

National Research Centre for Groundnut, Junagadh, India

Introduction. "The National Research Centre for Groundnut (NRCG) was established with the object of undertaking studies on both basic and applied research on groundnut to find solutions to some of the major problems holding up groundnut production in the country. Although the Centre came into existence on paper on 1 Oct 1979, the actual research work was started from 1981 after the joining of scientific and tecnical staff. The major objectives of the Centre are collection, maintenance, evaluation, and documentation of groundnut germplasm; breeding varieties for early maturity, high yield, resistance to biotic and abiotic stresses; utilization of wild *Arachis* species in groundnut improvement; studies on farming systems; physiological studies on productivity, water, temperature and salt stresses, mineral nutrition, seed dormancy and seed viability; studies on economically important diseases and insect pests including mycotoxins; nitrogen fixation in relation to *Rhizobium*, host and environment; and groundnut composition and quality in relation to oil and protein", writes P.S. Reddy, the Director of the Centre.

Genetic Resources. A working collection of 6000 accessions of cultivated groundnuts is being maintained by field planting and is being simultaneously evaluated for qualitative and quantitative traits. The results of evaluation are documented in the form of catalogs.

Cooperative multilocational investigations on field screening of spanish and valencia accessions for identification of cold-tolerant genotypes indicated that winter temperatures delayed seedling emergence, reduced plant growth, and delayed flowering. The collection showed considerable genetic differences for days-to-seedling emergence, days to flowering and maturity, and pod yield but no cold-tolerant accession could be spotted in the collection.

Breeding. Incorporation of earliness in spanish/valencia group and in virginia bunch/virginia runner group is being attempted.

In the spanish/valencia group, two most-promising cultures, NRGS(E) 2 and NRGS(E) 6, have been entered in the IET (early) in AICORPO for postrainy season (rabi/summer). Two sources of earliness, Robut 33-1 and Tifrun, are being used as donor parents to incorporate earliness into other varieties.

Some of the semispreading selections derived from the crosses spreading x bunch in the project on breeding for rust and late leaf spot resistance give high yield and are resistant to both rust and late leaf spot.

Under breeding for resistance to major foliar insect pests of groundnut, four sources of resistance to thrips, jassids, and leaf miner were crossed with four ruling varieties belonging to the spanish bunch group. Segregating populations in F_2 and F_3 generations are being critically examined for yield and pest reaction.

Three resistant lines were used to incorporate *Aspergillus flavus* resistance into both agronomic backgrounds. Some progenies obtained from the crosses Latur 33 x PI 337394 F and S 206 x PI 337394 F were found resistant to seed colonization by *A. flavus*.

Eight genotypes having oil content of 52-56%, identified at NRCG, have been involved in crossing with the ruling groundnut varieties of different habit groups. Selection for high yield has been made in early generations and screening for oil content is in progress.

Genetics and cytogenetics. Genetic studies include the inheritance of rust resistance, which was found to be recessive and a F_2 ratio of one resistant: six intermediate: nine susceptible plants was observed. Eight genotypes with greater peg strength were identified and one of them is being utilized in the breeding program. Inheritance and linkage relationships of several qualitative characteristics were studied. For the first time, a linkage map was proposed for genes governing four pod characteristics in groundnut.

Four interspecific triploid hybrids involving the diploids *A. chacoense* and *A. duranensis* and the cultivated tetraploid were obtained. These, with four other triploids, are being used for gene transfer from wild *Arachis* species. A highly fertile interspecific triploid was isolated, and is being used extensively. Three tetraploids with introgressed genes for resistance to rust and late leaf spot, and with high yield, were identified.

Tissue culture studies have been initiated for rapid multiplication of F_1 hybrids and rescue of hybrid embryos obtained from distant crosses. Calli were initiated from different explants of groundnut.

Sixteen high-yielding and early-maturing mutants were isolated from the M_3 generation after treating the cultivars J 11 and GG 2 with the mutagens EMS and DES. The high yield in these mutants was found to be primarily due to their bold seed size.

Agronomy. Agronomic studies revealed that water hyacinth (*Eicholnia crassipes*) is a good source of organic manure for groundnut production. Use of half-cut seeds (with intact embryo) as seed material results in a saving of 40% seeds material. In Saurashtra region of Gujarat, use of paired rows in the place of wide rows commonly used by farmers resulted in 26% yield increase. Intercropping sunflower along with groundnut under paired-row system increased the total oilseed production by 15%.

Physiology. Physiological studies on groundnut productivity and energy harvest revealed that genetic differences for dry-matter accumulation and partitioning exist in the virginia group and high crop growth rate and net assimilation rate during pod-filling phase contribute to higher pod yield.

Flowering and early pod development stages were found to be most sensitive to drought stress. Recovery after relief of stress is rapid in resistant cultivars.

Varietal difference in salinity tolerance during germination and subsequent plant growth were obtained. NaCl salinity was found to be more detrimental during germination. More than 5000 germplasm lines were screened for yellowing, caused by nutritional disorders. Seventeen lines were found to be resistant. Two released varieties--GG 2 and JL 24--were found to be relatively tolerant to yellowing.

Loss of seed viability in spanish groundnut varieties was found to be associated with the loss in seed-membrane integrity. Marked genotypic differences in seed viability were obtained during storage at room conditions. It was found that storage conditions influenced the viability of groundnut varieties. Storage of pods at low RH (35-50%) in polythene bags (300 gauge) could help in retaining viability.

Pathology. In the course of routine disease surveys during 1981-86, some new diseases, i.e., alternaria blight (*Alternaria tenuissima*), phoma leaf spot (*Phoma sorghina*), exerohilum leaf spot (*Exerohilum halodes*), fusarium leaf spot (*F. equiseti*), and powdery mildew (*Oidum arachidis*) have been reported on groundnut for the first time. The incidence of Peanut Mottle Virus (40% on summer groundnut of 1983) and fusarium wilt (*Exerohilum oxysporum*) (18-38% on rainy season crop of 1984), and root rot (*Microphomina phaseolina*) (21% on summer crop of 1985) have been reported for the first time in Gujarat state.

Ten germplasm cultures and two cross derivatives of JL 24 x Pl 298115 and R 33-1 x EC

76446 (292) have been identified as resistant to alternaria leaf spot (*Alternaria alternata*).

Epidemiological studies on foliar diseases conducted during 1985-86 indicated that in the July-sown crop the maximum disease development of alternaria leaf spot (59%), early leaf spot (29%), late leaf spot (51%), and rust (45%) occurred during August, September, and October, respectively. A temperature range of 21-32°C and 77-80% RH appeared to be congenial for foliar disease development.

Early planting (2nd fortnight of June), closer spacing (45 cm x 10 cm), intercropping with pigeonpea and castor (2:4 ratio), and spray of plant extracts (2%) like *mehandi* and neem and mycoparasite (*Verticillium lacani* and *Penicillium islandicum*) were found to be useful in managing the foliar diseases.

Nine genotypes were found to be resistant to *A. flavus* colonization. Wild species, i.e., *A. cardenasii* and *A. duranensis* were found to be highly resistant, and *A. stenosperma* moderately resistant, to seed colonization by *A. flavus*.

Seed soaking (1 h) with 2% solutions of rock salt, asafetida, turmeric powder, 2% aqueous leaf extracts of neem, *mehandi*, and 3-day windrow drying were found to be useful in preventing aflatoxin contamination in groundnut.

Entomology. Several groundnut germplasm accessions were screened for major insect-pest resistance, and 10 genotypes were found to be resistant to jassids, and 19 promising for resistance to leaf miner. TMV 7 and TMV 9 were found to be highly resistant to tobacco caterpillar.

Pteraminus labialis L. and *Lablab purpureus* L. were identified as new alternate hosts for leaf miner.

Microbiology. A survey conducted in the major agroecological zones of India revealed large variations in nodulation. The plants in general had better nodulation in the black soils but were mostly ineffective. Inoculation with two *Rhizobium* strains, i.e., IGR 6 and IGR 40, resulted in about 20% higher pod yields. *Rhizobium* strain IGR 68 was found to interact well with GAUG 10 and GG 2. A good deal of specificity between Robut 33-1 and NC 92 was also observed, which increased the yield by 40.8%. Inoculation of single *Rhizobium* culture as against composite *Rhizobium* inoculum was found to be beneficial.

Large variations for nodulation among the existing 5000 germplasm lines have been observed. In general, runner types had more nodules compared to valencia and spanish types.

Application of 25 kg N and 50 kg P_2O_5 and micronutrients, such as $ZnSO_4$ (25 kg ha^{-1} borax (10 kg ha^{-1}), and $FeSO_4$ (15 kg ha^{-1}), were beneficial for nodulation, nitrogen content, and increase in pod yield. Soil temperatures, both low and high, for prolonged periods reduced the infection by *Rhizobium* and nodular activity. Soil drought stress during flowering reduced nodulation by 63% and during pod-formation stages by 76%. Nitrogen fixation recovered when plants were relieved of drought stress during the vegetative phase.

Agronomic practices of growing tall intercrops, such as maize and pearl millet, reduced the nodulation and nitrogen fixation. Soil-applied insecticides like Sevidol ® and Dysanite ® had no detrimental effect while application of phorate (Thimet ®) reduced the nodulation. Rhizosphere micoflora, i.e., gram-negative bacteria were predominant in virginia runner varieties, which included a nonsymbiotic nitrogen fixing bacterium *Azotobacter*. The variations in bacterial populations were correlated to leaf area and total dry matter of plants.

Biochemistry. Eight varieties with 52-56% oil have been identified. Among the factors that influence higher oil productivity are maturity, micronutrients, and timely irrigation.

Higher oil synthesis was observed during 90-105 days in bunch, virginia bunch, and valencia types whereas in runner types it occurred during 120-140 days. Triacylglycerol (oil) content increased with maturity. Soluble sugars decreased while protein content remained unchanged during the same period. Oleic and linoleic acid contents increased while saturated fatty acids decreased during pod maturation. About 30 groundnut varieties have been analyzed for their fatty acid composition. Among the released varieties, Kadiri 2, M 37, TMV 2, MH 2, AK 12-24, and Dh 3-30 had higher oleic/linoleic acid ratios.

Studies on aflatoxins in groundnut indicated that the varieties with more than 3% testa phenols and less than 22% seed protein contained lower level of aflatoxins (<30 ppb). Sun drying, exposure to burning cow dung and its fumes, spray of 1% common salt were found to be useful in detoxification of aflatoxins (10-50% reduction).

(Extracted from "NRCG - Highlights of Research 1981-1986" by the Editors, IAN, with permission of the Director, NRCG.)

Workshop on Aflatoxin Contamination of Groundnut

D. McDonald (ICRISAT Center)

An International Workshop on Aflatoxin Contamination of Groundnut was held at ICRISAT Center 6-9 Oct 1987. Some 50 scientists from 26 countries joined ICRISAT scientists to present research findings, discuss recent advances in understanding of the groundnut aflatoxin problem, and consider research and extension approaches to evaluate, monitor, and control contamination of groundnuts at national and international levels. The meeting recommended the production of an Information Bulletin to provide useful advice on how to evaluate and monitor the contamination problem and how to control the invasion of groundnuts by the aflatoxin-producing fungi and the production of aflatoxins. The need to inform the public in general, and policymakers in particular, about the hazards posed by aflatoxin contamination of groundnut and some other agricultural commodities was highlighted.

ICRISAT has begun implementing the recommendations of the workshop by preparing a "Summary and Recommendation" document, based on the Workshop deliberations, which is available from ICRISAT (see section on "Recent ICRISAT Publications" for details). The full proceedings will follow.

Third Southern African Regional Groundnut Workshop

J.J. Abraham (ICRISAT Center)

The Third Southern African Regional Groundnut Workshop was held in Lilongwe, Malawi, from 13 to 18 Mar 1988. In his opening address, Malawi's Minister of Finance, Mr Louis Chimango expressed his country's gratitude to ICRISAT for the contribution it has made towards improving groundnut production in the Southern African Development Coordination Conference (SADCC) region.

The Workshop brought together 40 participants from Botswana, Ethiopia, Lesotho, Malawi, Mauritius, Mozambique, Swaziland, Tanzania, Zaire, Zambia, and Zimbabwe, as well as participants from ICRISAT Center, ICRISAT Sahelian Center, and the SADCC/ICRISAT Regional Groundnut Improvement Program. Papers reviewed research on breeding, entomology, and agronomy; early leaf spot disease; and new methods for detection of aflatoxin contamination.

Participants visited smallholder farms growing groundnut in the Lilongwe Plain (1100-1200 m altitude) where 70% of Malawi's groundnut is grown; the Chitala Agricultural Research Station (600 m altitude) in the Rift Valley; and farmers' fields in the Chinguluwe Settlement Scheme.

Peanut Utilization Workshop

L.R. Beuchat (Department of Food Science, University of Georgia, Georgia Experiment Station, Georgia 30212, USA)

A Workshop on Peanut Utilization was organized for the 7th World Congress of Food Science and Technology, 28 Sep-2 Oct 1987 in Singapore. Among the speakers were three Peanut CRSP scientists working on the GA/FT/TP project titled "Appropriate Technology for Storage/Utilization of Peanut." Dr V. Garcia from the University of the Philippines, Los Baños, and Dr V. Haruthaithansan from Kasetsart University, Bangkok, Thailand, spoke on groundnut utilization in their respective countries and Dr R. Brackett assessed the global problem of aflatoxins and technologies to remove them from groundnuts. In addition, Dr A. Wirakartakusumuh (Institut Pertanian Bogor, Indonesia), Dr A.M. Zain (University of Pertanian, Malaysia), and Dr R. Chiou (National Chiayi Institute of Agriculture, Taiwan) presented papers on groundnut utilization.

Information on procedures for drying and storing groundnuts was presented. Processes and technologies for utilizing groundnuts in products consumed in various countries were reviewed, and prospects for changes in consumption patterns in the future were addressed. All papers will be published in the Proceedings of the Congress.

Groundnut Modeling Training Workshop

S.M. Virmani (ICRISAT Center)

The First International Training Workshop on Groundnut Modeling was held at ICRISAT Center, from 23 Mar to 3 Apr 1987. It was cosponsored by the International Benchmark Sites Network for Agrotechnology Transfer (IBSNAT) and ICRISAT as part of the multilocational cooperative groundnut modeling experiments at several locations in India and one in Thailand. Scientists from Australia, Sri Lanka, Thailand, USA, and India attended. Topics included factors affecting crop phenology, photosynthesis, and growth; testing and validation of the PNUTGRO model developed by the University of Florida adaptation and system analysis; database management; risk analysis and applications for crop improvement; and the use of expert systems. Field visits interspersed through the program kept modelers in touch with reality. The participants brought 13 data sets of groundnut experiments conducted in areas ranging from 11°N to 32°N latitude to test the PNUTGRO model. These data sets provided excellent material for practical training in the use of the model. Deficiencies in the model were highlighted for future improvement. Future workshops are planned following which the proceedings will be produced.

Research Reports

A Groundnut Rosette Epidemic in Niger

P. Subrahmanyam[1], **Hamma Hassane**[2], **Amadou Mounkaila**[3], and **D.H. Smith**[3] (1. ICRISAT Sahelian Center, B.P. 12404, Niamey, Niger [via Paris]; 2. Institut national de recherches agronomiques du Niger [INRAN], Centre national de recherches agricoles [CRNA] de Tarna, B.P. 240, Maradi, Niger; and 3. Texas Agricultural Experiment Station, Texas A&M University, P.O. Box 755, Yoakum, TX 77995, USA)

During our surveys in all the major groundnut (*Arachis hypogaea* L.) growing areas of Niger in September 1987, we observed a severe epidemic of groundnut rosette in Maradi and Zinder. We examined 11 farmers' fields in villages between Maradi and Zinder, and observed that 6 showed 100% rosette incidence, 3 showed 75-85% incidence, and 2 showed 55% and 65% incidence. In the southern parts of Maradi and Zinder, the disease incidence ranged from 10% to 45%. Green rosette was dominant in all the fields affected by the disease. Plants were severely stunted, dark green, and bushy. Pegs were short and severely distorted with no pod formation. Groundnut rosette is expected to cause severe yield reductions in areas between Maradi and Zinder. The disease was not observed in villages close to the Niger-Nigeria frontiers and in Dosso.

A very severe rosette epidemic in 1975 (Mounkaila 1980) reduced Niger's total groundnut production by 80% from 217000 t in 1961-74 to 42000 t in 1975, with an average yield of 131 kg ha^{-1} (Anonymous 1987). In subsequent years, groundnut rosette was observed only sporadically, and the 1987 groundnut rosette epidemic occurred after a gap of 11 years.

Since the early 70's, groundnut production in Niger has declined drastically. The rosette epidemic of 1975 and droughts of 1969 and 1973 are considered to be some of the major reasons for the decline in area and production of groundnut in Niger (Mounkaila 1980). In 1987, there was a considerable increase in the area under groundnut but the rosette epidemic and the erratic rains experienced in 1987 in the major groundnut-growing areas may reverse the situation.

Trials conducted in the past with high-yielding rosette-resistant genotypes in different parts of Niger showed that the variety RMP 12 was suitable for the Gaya area, and KH 149B was suitable for the Maradi and Zinder areas. There is an urgent need for the multiplication and distribution of these varieties to farmers in Niger.

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Effects of Pesticides and Farmyard Manure on Crop-Growth Variability in Groundnut

P. Subrahmanyam, B.J. Ndunguru, and **D.C. Greenberg** (ICRISAT Sahelian Center, B.P. 12404, Niamey, Niger [via Paris])

Variation in crop growth is one of the major limiting factors of groundnut (*Arachis hypogaea* L.) production in Niger. During our surveys in 1986 and 1987, large variation in crop growth was observed in farmers' fields, especially in sandy soils, in all major groundnut-producing areas of the country. The affected plants were usually present in patches surrounded by apparently healthy plants. These patches were always distributed at random in the field irrespective of the contour, and the patches reappeared in the same area of the field year after year. Three distinct types of symptoms were observed on affected plants:

1. Plants severely stunted, chlorotic with poor root and shoot development. Severe necrosis of roots with shredding of cortex tissue and necrotic lesions on the pod surface. Plant mortality evident in some cases.
2. Plants severely stunted, bushy, dark green with mild mosaic symptoms on young leaves.
3. Plants severely stunted as in category 1, but older leaves showing black necrotic lesions on the margins. There were very few pods on any of these stunted plants.

The relative incidence of plants showing these symptoms varied greatly between locations. The factors contributing to the variation in crop growth in groundnut are not fully elucidated.

The present report deals with the preliminary results of investigations on the effects of some pesticides and farmyard manure (FYM) on crop growth variability in groundnut at the ICRISAT Sahelian Center, Sadoré, Niger, during the 1987 rainy season. Varieties used were TS 32-1, a spanish type originating from a cross between Spantex and TE 3 in Burkina Faso; 55-437, a spanish type selected in Senegal from a population probably received from South America; 796, a spanish type, introduced into Niger from Burkina Faso; and ICGS(E)22, an

Table 1. Effect of carbofuran and farmyard manure (FYM) on plant height and yield of groundnut (cv 55-437) at ICRISAT Sahelian Center, Sadoré, Niger, rainy season 1987. (Randomized-block design with six replicates under irrigation and four replicates under rainfed conditions, plot size 16 m^2).

			Yield (kg ha^{-1})			
	Plant height[1] (cm)		Irrigated		Rainfed	
Treatment[2]	Irrigated	Rainfed	Pods	Haulms	Pods	Haulms
Carbofuran + FYM	25	16	3040	2550	1750	1230
Carbofuran	21	15	2140	1300	1670	1050
FYM	14	10	1100	1030	780	700
Control	11	8	840	780	660	610
SE	±2	±1	±198	±144	±97	±62
CV(%)	24	22	27	25	16	14

1. Mean of five plants per replication.
2. Carbofuran (10 kg a.i. ha^{-1}) and farmyard manure (10 t ha^{-1}) were applied to field plots immediately before sowing.

ICRISAT line selected for earliness from Ah 65 x Chico.

Effect of FYM. The effects of different rates (0, 2.5, 5.0, 7.5, and 10.0 t ha^{-1}) of FYM on growth and yield of four groundnut genotypes [55-437, TS 32-1, 796, and ICGS (E) 22] were investigated at Sadoré. There were no significant effects of FYM on crop growth or yield of pods and haulms on any of the genotypes tested.

Effects of FYM and carbofuran. The effects of FYM (10 t ha^{-1}) and carbofuran (10 kg a.i ha^{-1}) on growth and yield of a groundnut genotype 55-437 were investigated under rainfed and irrigated conditions at Sadoré. The treatments consisted of either FYM or carbofuran, or both. Untreated plots served as control. At maturity, five plants were selected at random from each plot and the length of the main stem and tap root, number of leaves on the main stem, and number of pods $plant^{-1}$ were recorded. The crop was harvested at normal maturity and pod and haulm yields were recorded. Soil treatment with FYM and carbofuran or carbofuran alone was very effective in reducing the variability in crop growth and increasing the yield (Table 1). Soil treatment with FYM alone was not effective.

Effects of some pesticides. The effects of soil application of dibromochloropropane, dazomet, carbofuran, and aldicarb on controlling variation in crop growth and yield both under rainfed and irrigated conditions at Sadoré were investigated. Dibromochloropropane was most effective in reducing the variation in crop growth and increasing the pod and haulm yields under irrigation. Aldicarb was the most effective under rainfed conditions (Table 2). Plots treated with dibromochloropropane (irrigated) and aldicarb (rainfed) showed vigorous plant growth, whereas plants in control plots were stunted and chlorotic with severely necrosed root systems.

Most of the pesticides used in this study are general biocides and are also known to influence the physiological processes of the plant. The positive effect of these pesticides on growth and yield of groundnut is encouraging and needs further investigation to understand the role of various edaphic factors on crop variability in Niger.

Table 2. Effect of four pesticides on plant height and yield of groundnut (cv 55-437) at ICRISAT Sahelian Center, Sadoré, Niger, rainy season 1987. (Randomized-block design with four replicates under irrigation and five replicates under rainfed conditions, plot size 8 m^2.)

			Yield (kg ha^{-1})			
	Plant height[1] (cm)		Irrigated		Rainfed	
Treatment[2]	Irrigated	Rainfed	Pods	Haulms	Pods	Haulms
Dibromochloropropane	32	15	3850	3410	1860	1780
Dazomet	25	12	2890	2590	1100	1000
Carbofuran	17	14	2500	1980	1930	1660
Aldicarb	18	18	1970	1710	2250	1960
Control	12	11	1190	1090	1090	920
SE	±2	±1	±334	±327	±122	±195
CV(%)	23	12	27	30	17	30

1. Mean of five plants per replication.
2. Dibromochloropropane (20 L in 85 L of water ha^{-1}), carbofuran (6 kg a.i. ha^{-1}), and aldicarb (4 kg a.i. ha^{-1}) were applied to the field plots on the day of sowing. Dazomet (300 kg ha^{-1}) was applied 15 days before sowing.

Screening of Groundnut Lines for Resistance to Root-Knot Nematode

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Two-hundred-and-eleven groundnut lines were screened against *Meloidogyne arenaria.* Five plants of each line were raised in five 15-cm pots having sterilized field soil (calcareous type) and fine river sand (3:1). Seven days after germination, one seedling in each pot was inoculated with 1000 freshly hatched, second-stage larvae of *M. arenaria.* The plants were harvested 40 days after inoculation and the roots were washed free of soil, and rated for root-knot reaction using a 1-5 scale where 1 = immune = no galls, 2 = resistant = few galls (1-25 without egg masses), 3 = moderately resistant = few galls (1-25 with egg masses), 4 = susceptible = moderate galling (25-50 galls with egg masses), and 5 = highly susceptible = severe galling (more than 50 galls with numerous egg masses).

None of the lines tested were found immune, resistant, or moderately resistant to this nematode. Out of 211 lines tested, 185 were found highly susceptible, while 26, rated 4, were found susceptible, but these were the least affected of the lines tested (Table 1). Details about the lines, root-knot index, and soil population are available from the author, or the Editor, IAN.

The highest soil population of the nematode (15760 larvae pot^{-1}) was observed in groundnut line NRCG 1061 (NC Ac 2298), while the lowest (7160) was in NRCG 1034 (NC Ac 16409).

Similar results were also obtained by Miller (1972), Castillo et al. (1973), and Minton and Hammons (1975).

Table 1. Groundnut lines having moderate galling and soil population of 7160-10840 larvae pot^{-1} of *Meloidogyne arenaria*, Junagadh, Gujarat, India.

NRCG number	Other identity
84	Local Runner
148	AN 64813 B
215	C.No.3270
401	
473	VRR 271
786	NC Ac 602
805	NC Ac 170
1006	NC Ac 17039
1034	NC Ac 16409
1157	NC Ac 768
3199	C.No.37
3466	AL 4515
3516	AL 7789
3583	EC 7316
3587	EC 16697
3661	EC 35994
3683	EC 211077
3725	Godina
3817	No.418
3876	RS 218
3992	EC 21086
4077	27-13-1
4086	32-3-4
4118	278-4-1
5049	NC Ac 16895
5137	JH 25

Acknowledgement. Authors are grateful to Dr J.S. Gill, Project Coordinator (Nematodes), All India Coordinated Research Project, New Delhi, for supplying different lines of groundnut.

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Preliminary Survey for Nematode-Caused Diseases of Groundnut in Some Districts of Andhra Pradesh, India

S.B. Sharma (ICRISAT Center)

During March and April 1987, preliminary surveys nematode-caused diseases were conducted in 15 groundnut-growing areas of Andhra Pradesh, India (Fig. 1). Soil, root, and pod samples were collected by taking several cores in a field and making a composite sample. These samples were processed in the laboratory using Cobb's decanting and sieving technique followed by modified Baermann funnel technique (Schindler 1961) and nematode populations were determined in 250 cm^3 soil, 1-5 g roots, and pods. Pods were examined for the presence of any lesions.

Pratylenchus sp, *Tylenchorhynchus* spp, or *Criconemoides* sp, was always found to be the most prominent nematode at each site surveyed (Table 1). In Guttivarepalli village the stunt nematodes, *Tylenchorhynchus* spp, were most predominant. In some fields of this village, a pod disease characterized by brownish-black discoloration of the pod surface was observed. The disease, locally known as 'Kalahasti' malady has been reported to be caused by only one species, *Tylenchorhynchus brevilineatus* (Reddy et al. 1984). The disease intensity was severe in two fields in Guttivaripalli (fields a and b in Table 1) and low in other fields, even though some of the latter had high numbers of *Tylenchorhynchus* sp. In addition to *Tylenchorhynchus* sp, populations of the spiral nematodes, *Helicotylenchus* sp, the ring nematodes *Criconemoides* sp, and the root-knot nematodes, *Meloidogyne* sp were more frequent at Guttivarepalli in comparison to other locations surveyed. Galls on roots were very small and few, however, larvae were encountered in the soil samples. In one field, white females of *Heterodera* were found attached to the roots. In the Pallipalem area, samples were collected from the 'clump' disease affected fields. *Criconemoides* spp were found to be the most predominant in these fields, and small dark spots were observed on many pods. In Peddakandukur and Thumbarajapalli, distinct patches showing yellowing of foliage and poor growth were noticed. The lesion nematode (*Pratylenchus* sp) population was highest on the periphery of the bad patches in these two locations. The burrowing nematode, *Radopholus similis*, was observed on banana roots in a field adjacent to the groundnut field in Gangarajapuram village. Although this nematode has been found, and was pathogenic, on groundnut in USA (O'Bannon et al. 1971), it was not found on groundnut in Gangarajapuram.

Table 1. Number of nematodes in 250 cm^3 soil from groundnut fields in Andhra Pradesh, India, 1987.

Location	*Tylenchorhynchus* spp	*Pratylenchus* spp	*Helicotylenchus* spp	*Criconemoides* spp	*Hoplolaimus* spp	*Meloidogyne* spp	*Hirschmanniella* spp
Prakasham district							
Pallipalem[1]		-[2]	25	175[2]	50[2]	50[2]	
Peddakandukur[1]	125	500	75	25			225
Nellore district							
Thummuru[1]	175	75		50	50	100[2]	
Upperapalli[1]	50	225		75			
Chittoor district							
Guttivaripalli a	425	50[2]	100	250	100	350[2]	
b	263	75	125	113	63	175[2]	
c	238	250[2]	175	25	125	125	
d			225		25	75	
e	250			300		100	
f	225		25	75		75	75
Maglodpalli		75	25	50	50		
Gangarajupuram	325	100	50	50		25	75
Cuddapah district							
Thumbarajupalli[1]		500	350		75		
Kurnool district							
Sirivella	100	125[2]		50	50		
Arlagadda[1]		225	85		112		

1. Some pods with lesions were observed at these sites.
2. Nematodes were detected in root samples at these sites.

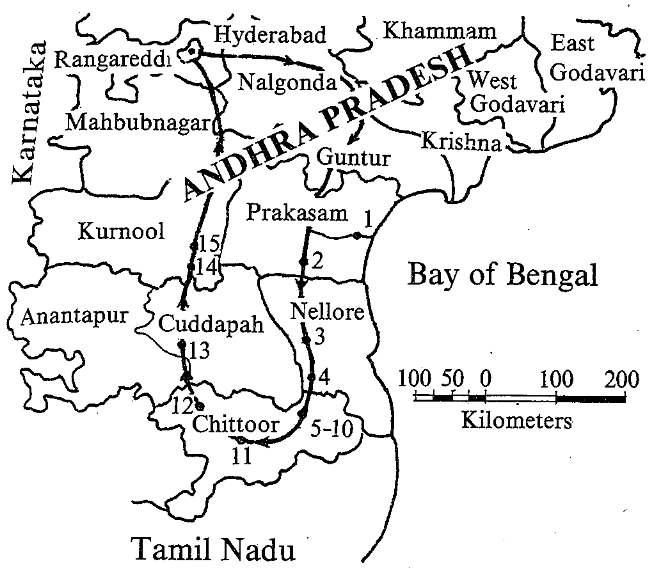

Figure 1. Route followed to survey nematode-caused diseases in some coastal and Rayalaseema districts, Andhra Pradesh, 1987. (Locations of surveys are marked 1-15).

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Isolation and Fusion of Protoplasts of *Arachis hypogaea* and *Arachis villosa*

Y.P.S. Bajaj and **S.S. Gosal** (Punjab Agricultural University, Ludhiana 141 004, Punjab, India)

The importance of the incorporation of wild germplasm into groundnut has been well emphasized. Due to various incompatibility barriers, biotechnological approaches, including protoplast fusion, have attracted much attention. Isolation and culture of protoplasts of *Arachis hypogaea* have been reported (Oelck et al. 1982). The present paper reports an attempt at isolation and fusion of protoplasts of *A. hypogaea* (2n=40) and *A. villosa* (2n=20).

The protoplasts were isolated from 2-mm segments of young leaves of 2-week-old seedlings of *A. hypogaea* cv M145, grown in vitro from seed, and shoot-derived callus and young leaves of *A. villosa*, in solutions of the enzymes cellulase and macerozyme (Table 1) containing $CaCl_2$ (0.03%) and mannitol (0.6M) at pH 5.6, and incubated for 9, 12, or 15 h. The best protoplast yield (1.4 x 10^5 protoplasts per

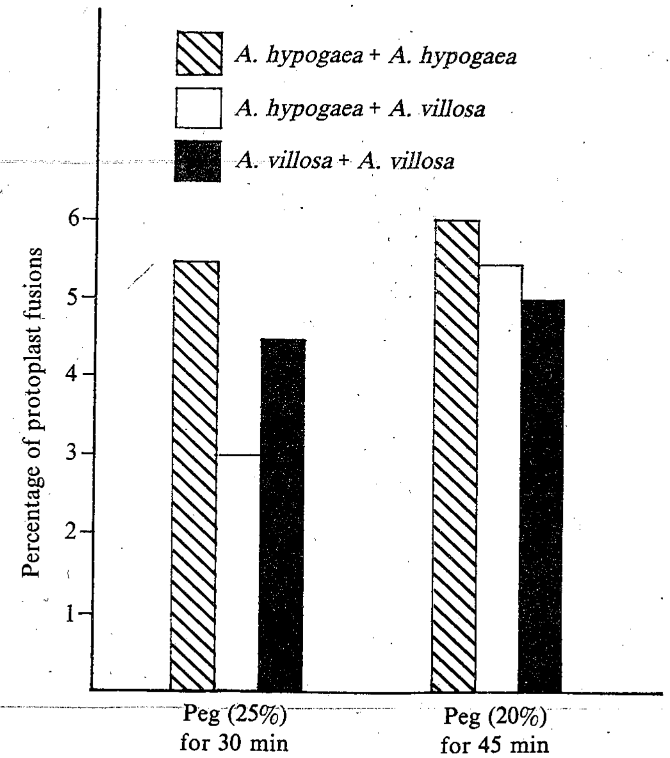

Figure 1. Frequency of protoplast fusion in *Arachis hypogaea* and *A. villosa* with 25% polyethylene glycol treatment for 30 min and 20% polyethylene glycol treatment for 45 min.

Table 1. Protoplast yield (x 10^5 per g fresh mass of leaves) of *Arachis hypogaea* and *A. villosa* in different enzyme solutions, Punjab Agricultural University, Ludhiana, Punjab, India.

	A. hypogaea Duration of treatment (h)			*A. villosa* Duration of treatment (h)		
Enzyme solution	9	12	15	9	12	15
E1 = cell 1% + mac 0.75%	0.4	0.6	0.8	0.2	0.3	0.5
E2 = cell 1.5% + mac 1%	0.5	0.7	1.4	0.3	0.6	1.2
E3 = cell 2.5% + mac 1.5%	0.7	0.9	1.2	0.4	1.0	1.2

gram of fresh leaf mass) was obtained in E_2 enzyme solution incubated for 15 h (Table 1).

Fusions were accomplished among the mesophyll protoplasts (green) of *A. hypogaea* and the callus-derived protoplasts (colorless) of *A. vilosa* by treatment with 20-25% polyethylene glycol (PEG 6000) for 30-45 min. Treatment with 20% PEG for 45 min yielded better results (Fig. 1), and there were comparatively fewer distortions. The fusion products could be easily distinguished.

The conditions for the isolation and fusion of protoplasts have thus been optimized, and continued studies on somatic hybridization are expected to result in wider genetic variability.

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Stability of Seed Mass in Confectionery Groundnut

S.L. Dwivedi, K. Thendapani, and **S.N. Nigam** (ICRISAT Center)

Seed mass in groundnut is an important trait that often determines its end use. Small-seeded groundnuts are, in general, crushed for oil whereas the large-seeded types are preferred for making a variety of confections. About one-third of the total world groundnut output is used for confectionery requirement, with a specific preference for large seed size. Therefore, the stability of seed mass assumes significant importance in a confectionery breeding program.

Development of groundnut cultivars with large seed mass is an important breeding activity at ICRISAT Center. Promising lines, derived from crosses between the large-seeded germplasm lines and high-yielding adapted varieties, are selected on the basis of pod yield and large seed mass [>80 g (100 seeds)$^{-1}$]. After replicated evaluation at ICRISAT Center and Subcenters, selected lines are channeled to national programs, in the form of international trials, to test their adaptability and stability for pod yield and seed mass in diverse groundnut-growing environments.

The first International Confectionery Groundnut Varietal Trial (ICGVT 85) consisting of 24 test entries, together with provision for one local variety as control, was sent to 16 countries in 1985 and the data for pod yield and 100-seed mass obtained from 10 locations were analyzed, following Finlay and Wilkinson (1963). Table 1 gives the range, mean, and regression coefficient of pod yield and 100-seed mass. While most of the lines yielded over 3 t ha^{-1} over the locations, considerable variation was observed between locations. Similarly most of these lines showed a wide range of variation for 100-seed mass. While several lines showed higher seed mass than the local control variety at individual locations, only two, recorded an overall mean 100-seed mass greater than 70 g. ICGV 86573 had 100-seed mass 77 g and ICGV 86725 recorded 100-seed mass of 73 g. In Zambia, USA, and Taiwan none of the lines could produce higher 100-seed mass than the local control variety.

Significant genotype x environment interaction was observed for both pod yield and seed mass. Regression coefficient (b) and per se performance, which determine the stability of a genotype over environments, have been plotted for seed mass (Fig. 1). Among the varieties included in the trial the cultivar, Robut 33-1 has the smallest 'b' value (0.72) and therefore appears most stable for seed mass. However, it is not suitable for confectionery use because of its lighter seed mass (51 g). A general increase in the 'b' value with the increase in seed mass indicates the sensitivity of this characteristic to environmental changes in these lines. Of the two lines, ICGV 86573 and ICGV 86725, with mean 100-seed mass greater than 70 g, ICGV 86725 was more stable compared to ICGV 86573.

Table 1. Range and overall mean for pod yield and seed mass of the 25 groundnut genotypes tested across 10 countries during 1986.

	Pod yield (t ha^{-1})			100-seed mass (g)		
Identity	Regression coefficient (b)	Mean	Range	Regression coefficient (b)	Mean	Range
ICGV 86981	0.83	3.34	1.45-4.89	1.10	62	39-93
ICGV 86982	1.04	3.36	1.09-5.61	0.75	50	34-77
ICGV 86983	0.77	3.58	1.30-5.06	0.79	59	40-80
ICGV 86984	1.01	2.90	1.15-5.78	0.88	55	32-77
ICGV 86547	1.06	3.30	1.13-5.01	1.19	64	40-95
ICGV 86723	0.77	3.06	1.45-4.68	1.10	52	31-79
ICGV 86025	1.04	3.27	1.37-5.19	0.88	54	32-77
ICGV 86986	0.80	3.21	1.32-5.25	0.78	60	39-78
ICGV 86573	1.23	3.73	1.35-7.89	1.50	77	62-110
ICGV 86727	1.25	3.75	1.28-5.89	0.99	57	35-89
ICGV 86566	1.01	3.12	1.23-5.84	1.13	67	38-95
ICGV 86988	0.94	3.24	1.52-5.47	1.24	59	36-89
ICGV 86989	0.97	3.21	0.78-5.72	0.92	53	34-87
ICGV 86724	0.79	3.37	1.45-5.22	1.03	63	41-95
ICGV 86725	1.02	3.57	1.24-6.04	1.06	73	45-93
ICGV 86996	0.87	3.33	1.45-5.15	1.01	61	37-93
ICGV 86559	0.91	3.44	1.50-5.47	1.08	64	40-91
ICGV 86726	0.91	3.36	1.32-5.18	0.77	64	41-82
ICGV 86993	0.97	3.48	1.56-5.66	0.77	60	41-78
ICGV 86730	1.03	3.35	1.44-5.59	0.81	55	33-72
ICGV 86995	1.17	3.14	1.08-6.31	0.99	59	38-81
ICGV 86574	1.26	3.29	1.02-6.97	1.23	69	44-93
ICGV 86561	1.33	3.63	1.40-9.00	1.21	65	43-89
Control						
Robut 33-1	0.83	3.29	1.54-5.19	0.72	51	31-68
Local variety[1]	1.15	3.64	1.25-7.56	1.02	67	39-117
SE	±0.13	±0.10	-	±0.19	±1.40	-
CV(%)			6-21			6-10

1. Cooperators were requested to include their best confectionery variety/line as local control in the trial.

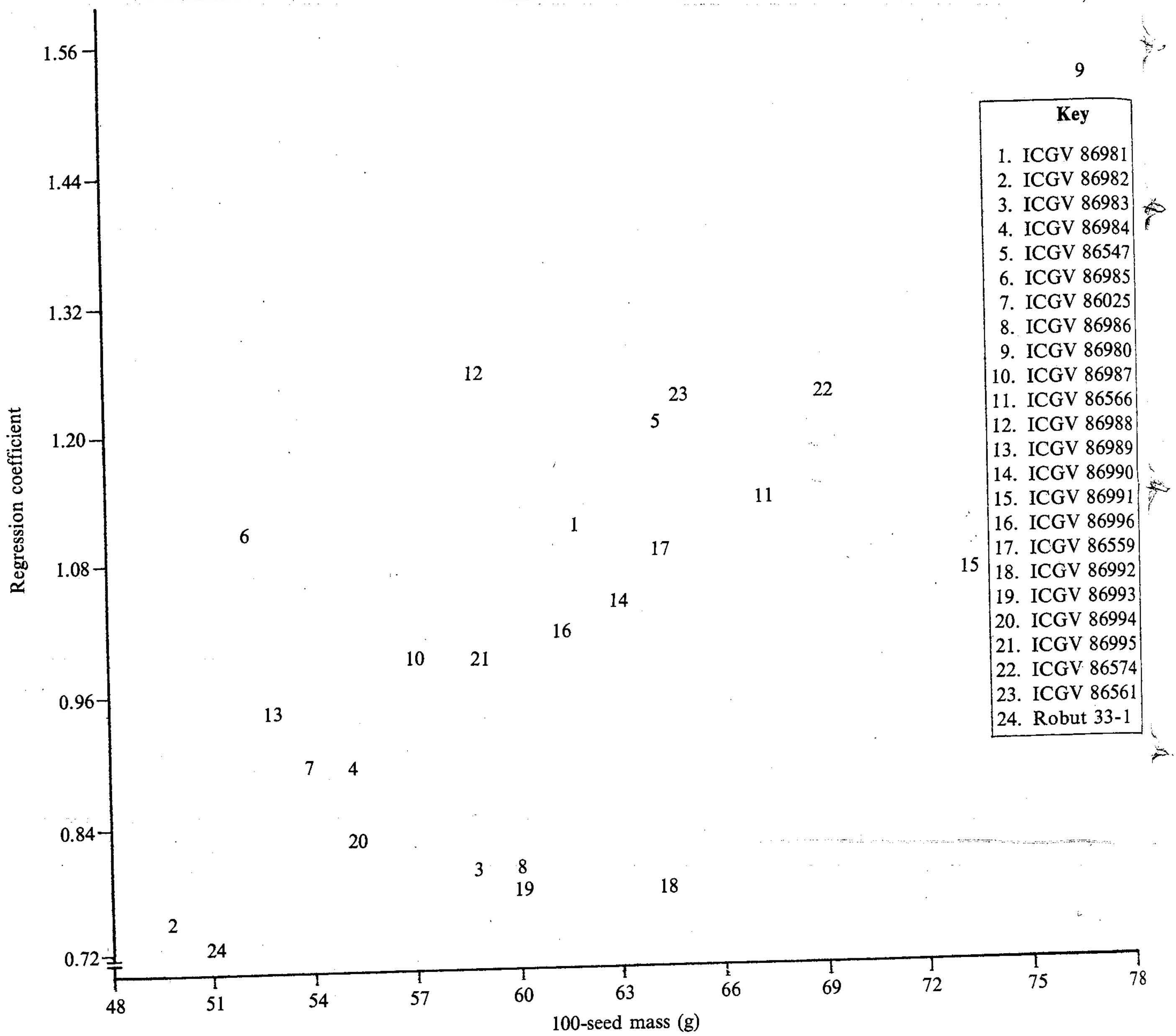

Figure 1. Regression coefficient (b) and 100-seed mass over locations for 24 confectionery groundnut lines.

Reference

Finlay, K.W., and **Wilkinson, G.N.** 1963. The analysis of adaptation in a plant breeding programme. Australian Journal of Agricultural Research 14:742-754.

Record of *Meloidogyne javanica* on Groundnut in Gujarat, India

D.J. Patel, B.A. Patel, J.C. Chavda, and **H.V. Patel** (Department of Nematology, Gujarat Agricultural University, Anand campus, Anand 388 110, Gujarat, India)

The groundnut crop in Kapadvanj area of Kheda district of Gujarat state was noticed to be severely stunted in growth, with yellowing of foliage. On uprooting such abnormal plants, the roots showed profuse galling due to root-knot nematode infestation. The nematode species was identified as *Meloidogyne javanica* by Dr A.C. Triantophyllu, Cytonematologist, N.C. State University, Raleigh, USA. Prasad et al. (1964) have reported *M. javanica* on groundnut in Delhi, and Sakhuja (1984) in Punjab state of northern India. This is the first report of *M. javanica* on groundnut from Gujarat state.

References

Prasad, S.K., Das Gupta, D.R., and **Mukhopadhyay, M.C.** 1964. Nematodes associated with commercial crops in north India and host range of *M. javanica.* Indian Journal of Entomology 26:438-446.

Sakhuja, P.K. 1984. Studies on the interrelationship between root-knot nematode, *Meloidogyne javanica* and root-rot fungi on groundnut. PhD thesis, Indian Agricultural Research Institute, New Delhi.

Groundnut Digger (ICRISAT Design) for Hard Soils

N.K. Awadhwal and **T. Takenaga** (ICRISAT Center)

Groundnut is grown primarily in rainfed dryland conditions and about 67% of the total world production comes from areas of the semi-arid tropics (SAT). It is important to harvest the crop at the optimum time, so that maximum yield of best quality pods with high shelling percentage, oil content, and high seed weight are obtained. The moisture content of the soil influences the ease of harvesting groundnut and in the SAT regions drought stress during the late stage of pod development is a common occurrence. Under such drought conditions most soils, except sandy soils, become hard and lead to harvesting problems. Under hard-soil conditions lifting of plants with pods cannot be done manually and the existing groundnut-lifting implements, mainly blade types, fail to penetrate to a desired depth and are not satisfactory. As a result, harvesting of the rainfed crop has to be postponed until the soil is moist from subsequent rainfall. Delay in harvesting leads to increased invasion by pod-rotting fungi, resulting in deterioration of the quality of the produce and the pod detachability increases, leading to increased harvest losses.

To overcome this problem, a groundnut digger for digging bunch type groundnut in dry and hard soils has been designed and developed at ICRISAT Center. It consists of a digger-bottom and a standard. Based on functional requirements, the digger-bottom has two shares that are inclined at 120° with each other and contain chisel points for increased penetration into hard soils. A single digger-bottom attached to a toolbar can be pulled by a pair of oxen and two or more digger-bottoms can be pulled behind a tractor (Fig. 1).

A tractor-drawn unit consisting of two digger-bottoms attached to a toolbar was tested in the field, for digging groundnut (bunch type) from an Alfisol. The soil was dry (moisture content=4%) and hard (Cone index = 18 kg cm^{-1}). It covered a 1-m wide strip and performed quite satisfactorily, whereas a blade-type digger failed to penetrate to the desired depth. The groundnut digger penetrated into the hard soil and undercut the main roots of plants leaving them upright. The plants were then lifted manually, without any problem of pod-soil separation as the digger had loosened the soil. The harvesting losses were less than 2.5%. A single digger-bottom was pulled by a pair of bullocks and covered a 40-cm strip or one row of the crop.

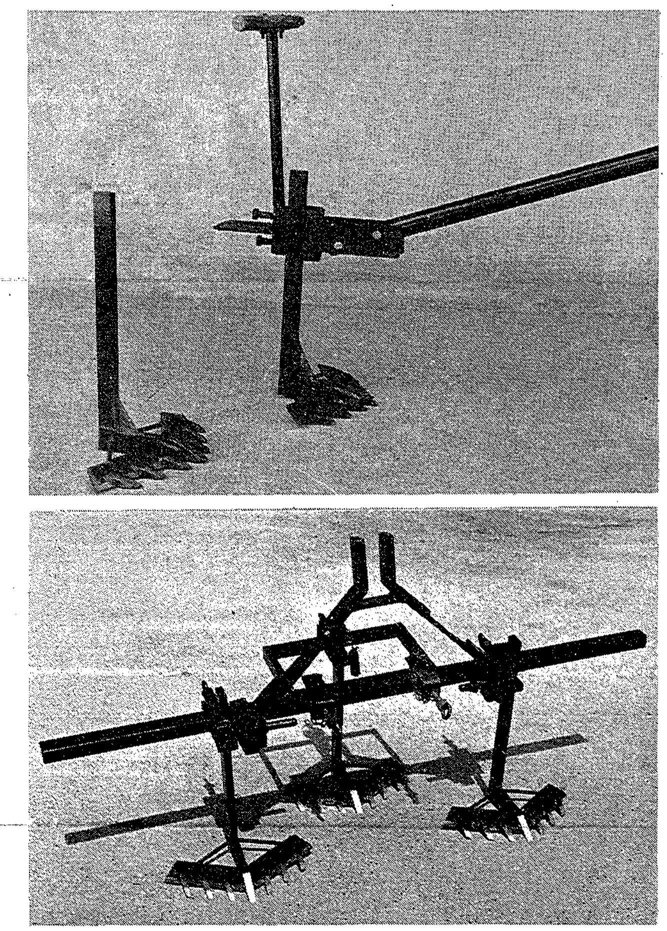

Figure 1. Groundnut diggers (ICRISAT design) for dry and hard soils.

Some Solutions to Insect-Identification Problems

J.A. Wightman (ICRISAT Center)

There are many problems associated with identifying insects and related animals. Therefore, most entomologists who are not taxonomists need, at some time or another, to seek advice about the latest names given to their specimens. The first problem is to identify the taxonomist. The names of some individuals and organizations who can help in this regard are as follows:

CAB International Institute of Entomology. This Institute, formerly the Commonwealth Institute of Entomology, provides the 29 Commonwealth countries a free insect-identification service. The charges for non-Commonwealth countries are:

20 Pounds Sterling for each identification to species
16 Pounds Sterling for each identification to genus
6 Pounds Sterling for each confirmation of an identification.

Discount and contract terms can be arranged. Write to The Director, CAB International Institute of Entomology, 56 Queen's Gate, London, UK, for information about the terms, conditions and, in particular, instructions about the best way to preserve and mail specimens. This organization can deal with specimens from most taxa and is in close contact with organizations that can provide additional expertise.

The Zoological Survey of India. The Zoological Survey of India undertakes the identification of properly preserved zoological specimens, with the exception of millipedes. There is no charge, although there may be limits in the geographical range. Write to the Director, Zoological Survey of India, 234/4 - Acharya J.C. Bose Road, IInd M.S.O. Building, Nizam Palace (14th Floor), Calcutta, India.

National Museums of Kenya. The Head of the Entomology Department, National Museums of Kenya, offers an identification service for East African insects only. He expects donor-funded projects to provide their own funding, the fees being about Kshs 200/- for a species and Kshs 100/- for a genus identification. Unfunded country projects receive a free service, but may be charged if the collection is large. Details of this service are described in Ritchie (1985). Write to The Director/Chief Executive, National Museums of Kenya, P.O. Box 40658, Nairobi, Kenya.

In response to a questionnaire, a number of individuals provided an indication of the insect identification service they or their organization could provide (Table 1). I would be grateful to newsletter readers who can put me in contact with entomologists who can be included in future lists.

Reference

Ritchie, J.M. 1985. Insect pest identification a new service for East Africa. Span 28(3).

Table 1. List of entomologists willing to identify specimens, with the relevant details (see text for list of institutions).

Contact person	Taxa that can be handled	Charges	Time	Comments
Prof Dr H.Fuersch Universitat Passau Didaktik der Biologie Postfach 25 40 D - 8390 Passau West Germany	Coleoptera:Coccinellidae	Postage	Normally 4 weeks	Keeps every third specimen
Dr A. Jansson Zoological Museum Division of Entomology Pohjoinen Rautatiekatu 13 SF-00100 Hilsinki 10 Finland	Heteroptera: Corixidae	None	Variable	Keeps 10-20% of duplicate specimens
Dr C. Silvano c/o Museo Civico di Storia Naturale S. Croce 1730 30125 Venezia, Italy	Diptera: Ephydridae (palaearctic afrotropical) Dolichopodidae (palaearctic)	None		
Dr R. Gianni c/o Museo Civico di Storia Naturale S. Croce 1730 30125 Venezia, Italy	Diptera: Empidoidea (Nepal and afrotropical)	None		
Dr V. Pierpaolo Via J. Diedo 6 A 30126 Venezia-Lido, Italy	Coleoptera: Histeridae (palaearctic, asiatic, afrotropical)	None		
Dr L. Papp Biosystematic Service in Entomology Zoological Department Hungarian Natural History Museum Budapest, Baross u.13 H-1088, Hungary	Coleoptera, Diptera, Lepidoptera, Hymenoptera (Symphyta and Braconidae) Homoptera, Heteroptera, millipedes, nematodes, molluscs, Acari	US$5.00 for first and 20 cents for subsequent specimens	2 weeks	Keeps one specimen, but does not charge for it
Dr H.G. Cogger Australian Museum P.O. Box A285 Sydney, South Australia	Wide experience of problems of the Pacific region	None stated		Pacific region only
Prof M.J. Samways Dept Zoology and Entomology University of Natal Pietermaritzberg 3200 South Africa	Acalyptrate Diptera Hymenoptera: Mutillidae	None	2 weeks	Likes to keep mutillids
Dr C.B. Cottrell Lepidoptera Department Transvaal Museum Box 413, Pretoria 0001 South Africa	Lepidoptera	Variable	None stated	May wish to retain up to half the material

Continued.

Table 1. *Continued.*

Contact person	Taxa that can be handled	Charges	Time	Comments
Dr G.L. Prinsloo National Collection of Insects Plant Protection Research Institute Private Bag X 134 Pretoria 0001 South Africa	Coleoptera: Curculionidae Homoptera: Aphidoidea, Coccoidea (southern African only) Hymenoptera: Chalcidoidea, Apoidea (afrotropical)	None	1-2 months	
Dr S. Louw Department of Entomology National Museum P.O. Box 206 Bloemfontein 9700 South Africa	Coleoptera (families) Heteroptera (families) Aranae (families)	None	4 weeks	20% retention

Recent ICRISAT Publications

The publishing address for each item is: ICRISAT, Patancheru, Andhra Pradesh 502 324, India.

ICRISAT. 1987. Research on grain legumes in eastern and central Africa. Summary proceedings of the Consultative Group Meeting for Eastern and Central African Regional Research on Grain Legumes (Groundnut, Chickpea, and Pigeonpea). 8-10 Dec 1986, International Livestock Centre for Africa, Addis Ababa, Ethiopia. 128 pp. Cost: LDCs U.S.$6.40; HDCs U.S.$19.20; India Rs.80.00.

ICRISAT. 1988. Summary and Recommendations of the International Workshop on Aflatoxin Contamination of Groundnut, 6-9 Oct 1987, ICRISAT Center, India. Cost:LDCs U.S.$2.70; HDCs U.S. $6.60; India Rs.28.00. Available free of cost to all concerned with the aflatoxin problem.

ICRISAT. 1987. Proceedings of the Second Regional Groundnut Workshop for Southern Africa, 10-14 Feb 1986, Harare, Zimbabwe. 164 pp. Cost: LDCs U.S.$8.20; HDCs U.S.$24.60; India Rs.103.00.

ICRISAT. 1987. Groundnut rust disease: proceedings of a Discussion Group Meeting, 24-28 Sep 1984, ICRISAT Center, India. 210 pp. Cost: LDCs U.S.$10.60; HDCs U.S.$31.80; India Rs.133.00.

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